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IRON AGE

MANUFACTURING MANAGEMENT

COMPUTERS IN MANUFACTURING:
OFF THE DRAWING BOARD AND INTO THE FACTORY
PLUS A GUIDE TO NEW PRODUCTS IN THE MARKETPLACE

NEW TECHNOLOGY SPURS A CASTINGS AND FORGINGS REVIVAL IN DETROIT

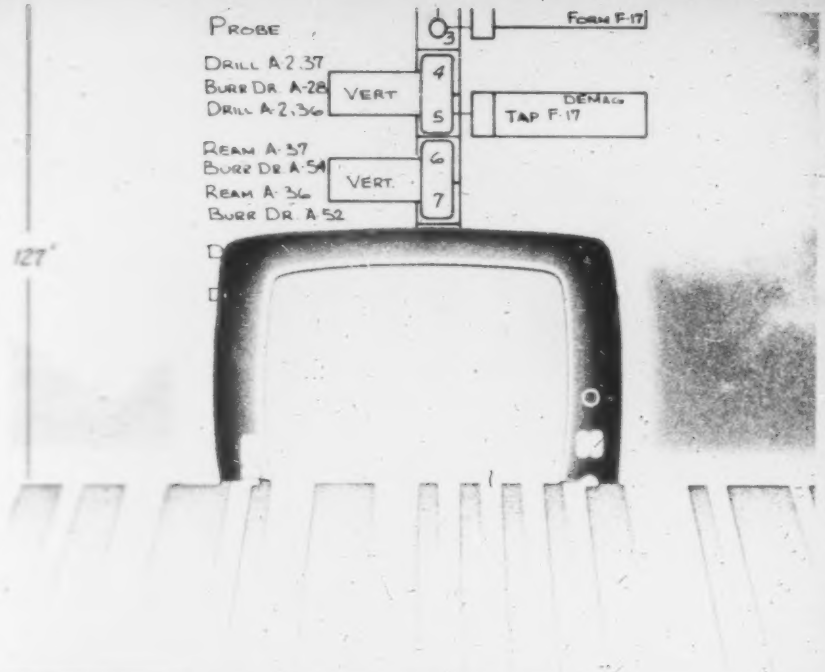
TREASURY TAX PLAN: IGNORING THE FUTURE AT OUR OWN PERIL?

4TH QUARTER EARNINGS: BIG STEEL STILL BATTERED;
NONFERROUS DEALT A SETBACK

TORQUE TIGHTENING: A COMPETITIVE EDGE IN FASTENING SYSTEMS

MARCH 15, 1985 VOL. 228, NO. 6

IRON AGE
MANUFACTURING MANAGEMENT



Departments

EDITORIAL STAFF	8
SIGNED, SEALED AND DELIVERED	12
INDUSTRIAL BRIEFS	23
AD INDEX	66
MANAGEMENT SERVICE CARD	67
BUSINESS STAFF	68
P&P DATA 2/18	72
FERROUS SCRAP 2/18	73
CLEARING HOUSE	74

Editorial 7
Why not stand up and howl?

Newswatch 15
Knowledge engineering puts the expert's expertise on line.

Price Trends 22
Falling energy prices keep a lid on inflation.

Machine Tool Report 26
Kennametal launches a European campaign.

You and Your Job 29
How a manager should handle the constant complainer.

Charls E. Walker 30
The former Treasury official sees some pitfalls in the tax plan.

Castings 33
The 'lost foam' technique finds a new life for automotive castings.

Torque Tightening 44
The fastener industry is meeting the import challenge.

Steel/Nonferrous Earnings 47
The metals producers close the book on 1984 and look forward to 1985.

Computers in Manufacturing 52
Computer-integrated manufacturing (CIM) is no longer science fiction.

Computer Product Guide 62
Small, versatile PC replaces electromechanical devices.

Materials Report 76
New orders for steel are matching last year's pace.

Next Issue: Second Quarter Forecast

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FALLING ENERGY PRICES KEEP A LID ON INFLATION

January producer prices showed no change from December despite jumps within several individual categories of the index, the U.S. Commerce Department said. The index has stayed the same or declined in seven of the past 12 months.

Declining energy prices offset increases in other categories by dropping 2.4 pct in December, the biggest monthly decline since March 1983 when they fell 3 pct.

Nevertheless, government price watchers see another ominous trend in the latest price report—an unusually fast acceleration (0.6 pct) in all categories except food and energy. Until January this part of the index rose no more than 0.3 pct in any month since last March.

Commerce analysts said January is a month in which companies that raise prices only once a year choose to do so and this month they raised them higher than usual. This, the Commerce Department said, could account for the sharp 1.7 pct jump in prices for both autos and light motor trucks. Prices for both will rise again, but not in the foreseeable future, the government said.

Raw material prices dropped 2.2 pct in January, the sharpest decline since April 1980 and a sign that there is little upward pressure on prices for the next several months.

Moderate economic growth, industry expansions, firm monetary policy and the strong dollar are the factors keeping inflation in check. The strong dollar has been making foreign goods cheaper for American consumers and forcing U.S. producers to keep their prices in line.

And just as auto prices went up, so did auto production, according to the Federal Reserve. U.S. factory production rose 0.4 pct, a modest hike. The resumption of full production in auto plants took the annual production rate up more than 6 pct.

Latest Month Covered: January 1985

Products	Index Reading For Month (1967 = 100)	Pct Change From Previous Month	Pct Change From Year—Ago Month
Metal Cutting Machine Tools	389.4	— 1.3	+ 2.9
Metal Forming Machine Tools	430.0	+ 0.3	+ 2.6
Agricultural Machinery & Equip.	338.5	+ 0.3	+ 2.3
Construction Machinery & Equip.	360.4	+ 0.6	+ 1.8
Industrial Process Furnace & Ovens	381.7	+ 0.2	+ 3.1
Industrial Material Handling Equip.	292.4	+ 0.1	+ 1.9
Pumps, Compressors & Allied Equip.	353.2	+ 0.3	+ 1.9
Fluid Power Equip. (Dec. 1970 = 100)	261.9	0	+ 2.7
Mechanical Power Transmission Equip.	335.3	+ 1.4	+ 4.2
Automobiles	227.2	+ 1.7	+ 2.4
Motor Trucks—Light	294.4	+ 1.7	+ 5.0
Motor Trucks—Heavy	331.2	0	+ 2.0
Railroad Equipment	358.9	0	+ 2.1
Fabricated Metal Structural Products	312.8	— 0.1	+ 2.1
Electric Motors	348.9	+ 2.0	+ 3.5
Valves & Fittings (Dec. 1982 = 100)	103.6	+ 0.8	+ 3.3
Ball & Roller Bearings	345.8	+ 0.4	+ 2.9
Cutting Tools & Accessories	285.0	+ 0.6	+ 3.0
Heating Equipment	256.6	+ 0.1	+ 3.8
Plumbing Fixtures & Brass Fittings	306.4	+ 1.2	+ 4.3
Metal Containers	357.6	0	+ 3.9
Miscellaneous Metal Products	301.8	+ 0.1	+ 4.0

Data based on U.S. Labor Dept.'s Producer Price Index

4th QUARTER EARNINGS

STEEL BATTERED; NONFERROUS DEALT SETBACK

BY GEORGE MCMANUS & ROBERT REGAN

The domestic steel industry as a whole lost money for the third straight year, while nonferrous metals producers found it difficult to squeeze out much in the way of profits.

Steel

Help is on the way, and it will hopefully arrive in time for the ailing steel industry.

After a disastrous 1984, demand for steel has risen about 30 pct. If the improvement continues, it should ward off the drastic attrition that now threatens.

"I look for a fairly strong operating environment to surface by midyear," said Robert A. Hageman, vice president, Kidder Peabody & Co. Mr. Hageman pointed out that very minor increases in steel volume and prices can have enormous impact on profits.

There's no question the steel industry has the potential for a dramatic turn-around. Obscured by the terrible conditions of recent times has been a massive cost reduction. Given a halfway decent market, the cost cuts will translate into spectacular profits.

It's also true, however, that there is the potential for terminal trouble. In 1984, the steel industry as a whole lost money for the third straight year. As the year advanced, things got worse instead of better.

The bleeding can't continue much longer without major casualties. "None of the options are good," said John C. Tumazos, analyst for Oppenheimer & Co.

Mr. Tumazos said bankruptcy was one of the options. Once mentioned only in hushed tones, steel failures were openly and widely discussed in early 1985.

Wheeling-Pittsburgh Steel Corp. can't survive without a restructuring of its debt, warned Paul Rusen, director of the Wheeling district of United Steelworkers of America.

Mr. Tumazos said steel operating losses were as high as $47 a ton in the fourth quarter of 1984. He said hard pressed steel companies may have to sell off prize assets. "What all these companies need is an infusion of equity."

Mr. Hageman agreed things were tough. "There's no question the balance sheets of all the companies are bad," he said, noting that short term debts exceed cash. He was optimistic that the Reagan Administration's import curbs would ease the crisis.

"I think there will be some improvement this year," he said. He expected the steel industry to follow the same scenario that saw auto profits zoom after car imports were restricted.

The peril and the promise of the steel industry were brought out by Mr. Tumazos' estimates of losses on actual steel operations. Leaving out taxes and special accounting adjustments, he calculated that United States Steel Corp. lost $33 a ton in the fourth quarter of 1984. That wasn't too good, but it compared with a U.S. Steel loss of $241 a ton in the fourth quarter of 1982.

The reduced loss suggested that there had, indeed, been a deep cost cut. The losses of other major mills show comparable declines.

While the whole steel industry took a beating last year, there were striking differences between mills. The big success story was Weirton Steel Corp. The $60.6 million profit of Weirton came to a very respectable 5.6 pct of sales. Weirton's experiment in employee ownership got off to a rousing start.

"The sacrifices of our employees and a fine team effort in cost control helped us to operate in the black," said Robert L. Loughhead, president of Weirton.

At the other end of the spectrum was the $378 million loss of LTV Corp. in 1984. LTV's steel business had an operating loss of $152 million. That included a charge of $74 million from facility rationalization and staff reductions.

LTV has lightened its capital burden by joining with Sumitomo Metal Industries, Ltd., in a big electrogalvanizing project. Wheeling-Pittsburgh has teamed up with Nisshin Steel Company, Ltd. in a galvanizing line. Nippon Kokan has acquired a half interest in National Steel Corp.

There could be other deals of this type as domestic mills seek added equity. The problem is that the least saleable assets are the ones companies would like to shed. LTV could find a ready market for its profitable defense business, but the company's Gadsden plant hasn't been snapped up by outside interests.

STEEL: BIG REDS AND LITTLE BLACKS

1984 PROFIT REPORT (In Millions of Dollars)

		EARNINGS			SALES		
	1984 E/S	1984	1983	Pct Change	1984	1983	Pct Change
USS	2.6	493.0	($1,161.0)	--	$19,104.0	$17,539.0	+9
LTV	--	(378.2)	(180.7)	--	7,046.1	4,577.8	+54
BETHLEHEM	--	(112.5)	(163.5)	--	5,392.1	4,898.2	+2
ARMCO	--	(295.0)	(672.5)	--	4,543.1	4,164.6	+9
INLAND	--	(41.4)	(116.9)	--	3,324.8	2,929.4	+14
NATIONAL	2.3	52.6	(154.3)	--	2,294.3	2,922.7	-22
TOTAL	--	(281.5)	(2,448.9)	--	41,664.4	37,031.7	+13
CYCLOPS	1.4	18.4	(2.2)	--	1,271.6	1,024.1	+24
WEIRTON	5.6	60.6	--	--	1,075.1	929.0	+16
INTERLAKE	4.3	36.6	22.8	+60	845.1	763.6	+11
NUCOR	6.7	44.5	27.9	+60	660.3	542.5	+22
COPPERWELD	1.0	4.5	(24.3)	--	442.2	325.5	+36
LUKENS	1.1	4.7	(14.0)	--	416.4	342.9	+21
QUANEX	0.5	2.0	(3.5)	--	398.3	297.4	+34
CF&I	--	(28.2)	(94.2)	--	325.3	231.1	+41
FLORIDA*	2.3	6.7	(4.7)	--	286.1	235.1	+22
EASTMET	--	(13.8)	(8.2)	--	238.9	192.2	+24
LACLEDE	3.2	7.5	2.8	+165	231.6	190.2	+22
CARPENTER**	5.9	8.1	6.6	+22	137.8	116.8	+18
PHOENIX	--	(6.4)	(32.1)	--	124.9	112.0	+12

*Quarter only **Year ending Sept. 30

STEEL 4TH QUARTER PROFIT REPORT—1984 (In Millions of Dollars)

		EARNINGS			SALES		
	1984 E/S	1984	1983	Pct Change	1984	1983	Pct Change
USS	0.6	29.0	(983.0)	--	4,659.0	4,712.0	-1
LTV	--	(246.7)	7.5	--	2,008.9	1,511.5	+33
BETHLEHEM	--	(64.5)	(27.4)	--	1,188.7	1,322.5	-10
ARMCO	--	(64.5)	(46.8)	--	1,118.6	1,067.2	+5
INLAND	--	(28.3)	(45.9)	--	776.0	831.9	-7
NATIONAL	7.2	12.8	(38.0)	--	177.0	784.3	-77
TOTAL	--	(387.8)	(1,133.6)	--	9,927.8	10,229.5	-3

NONFERROUS: A MIXED BAG

4TH QUARTER PROFIT REPORT—1984 (In Millions of Dollars)

	NET INCOME			SALES AND OTHER REVENUES		
	1984	1983	Pct Change	1984	1983	Pct Change
ALCAN	$20.0	$55.0	-63.6	$1,319.0	$1,408.0	-6.3
ALCOA	(14.7)	96.3	--	1,386.0	1,469.7	-5.7
ASARCO	(236.3)	11.7	--	282.2	392.5	-20.5
BRUSH WELLMAN	9.8	7.9	+24.1	79.2	65.7	+20.5
CABOT	24.5	17.5	+40.0	559.3	399.9	+39.9
COMINCO	(5.1)	1.1	--	376.5	394.1	-4.5
ECHO BAY	6.8	3.8	+78.9	24.6	15.9	+54.7
FALCONBRIDGE	9.0	10.5	-14.3	204.4	176.9	+15.5
HECLA MINING	(3.4)	5.4	--	22.2	36.1	-38.5
INCO	4.5	(54.6)	--	388.8	348.0	+11.7
KAISER ALUMINUM	(27.8)	42.0	--	897.2	775.8	+15.6
MARTIN MARIETTA	33.3	37.4	-11.0	1,118.2	914.0	+22.3
NEWMONT MINING	5.6	1.5	+273.3	194.1	195.6	-0.8
OLIN	12.2	12.2	--	496.0	484.9	+2.3
PINE POINT MINES	3.7	1.2	--	29.6	24.8	+19.4
REVERE COPPER	8.6	12.7	-32.3	143.1	146.4	-2.3
REYNOLDS METALS	38.4	12.3	+212.2	839.6	846.6	-0.8
VULCAN MATERIALS	17.4	18.1	-3.9	254.5	232.2	+9.6

Alcan Aluminium Ltd: Net includes $8 million in '84 period and $15 million in '83 period extraordinary gains from tax-loss carryforwards. **Aluminum Co. of America:** Loss for '84 quarter includes writedowns of $41 million on Mobile, Ala. alumina refinery, $7.5 million on write-off of an equity investment in Grenoble, France, and $5 million write-off of construction costs for a potline at Badin, N.C. smelter which will not be completed. There also was an $11.8 million charge for reevaluation of tax liabilities for the year, a foreign exchange currency loss of $6.4 million and a $20.5 million gain on the sale of company's share in a partially completed power generating complex in Texas. **Amax Inc.:** Results for the '84 quarter include $205 million loss provision on properties and investments and a $5.4 million loss on sale of oil and gas properties. Loss for the '83 period includes a $308.8 million loss provision on properties and investments. The '84 period also includes a $9 million reversal of tax benefit from a tax-loss carry-forward. **Asarco, Inc.:** Loss for '84 period includes pre-tax charges of $216 million from closing of certain facilities and writedown of assets. Net for '83 period includes pre-tax gain of $20.4 million from sale of tax benefits and a mineral prospect. Results for both periods exclude preferred stock dividend requirements. **Brush Wellman Inc.:** Net for the '83 period includes a $68,000 loss from discontinued operations. **Cominco:** Canadian funds. **Falconbridge Ltd.:** Canadian funds. **Hecla Mining Co.:** Net loss for '84 period includes $879,000 debit for reversal of tax-loss carry-forward. Net for '83 period includes extraordinary credit of $389,000. **Inco Ltd.:** Net for both periods excludes preferred stock dividend requirements. **Kaiser Aluminum & Chemical Corp.:** Sales for '83 period are restated to reflect discontinued operations. Net income for '83 includes $9 million loss on discontinued operations. **Martin Marietta Corp.:** Sales for '83 period are restated to reflect discontinued operations. Net income for '83 period includes $5.6 million income from discontinued operations. **Pine Point Mines Ltd.:** Canadian funds. **Phelps Dodge Corp.:** Results for '84 period includes $195 million pretax charge relating to the restructuring of certain operations, of which $85 million reflects disposal of Western Nuclear, Inc. and other energy operations. **Revere Copper & Brass, Inc.:** Net for the '83 period includes $615,000 tax benefit from tax-loss carry forward. **Reynolds Metals Co.:** Net for '84 period includes $6.3 million extraordinary gain from tax-loss carry forward. Net for '83 includes $9 million charge on a plant closing.

U.S. Steel had profits of $29 million in the fourth quarter and $493 million for the year. An operating profit of $142 million was reported for the steel segment. That came to $12 a ton, which compared with a loss of $55 a ton in 1983.

The troubles of Bethlehem Steel Corp. continued in 1984. Bethlehem lost $64 million in the fourth quarter and $112 million for the year. The company's steel sector had an operating loss of $67 million in the fourth quarter.

Bethlehem wasn't counting on an early end to its difficulties. "There is a substantial overhang of inventories because of the flood of imports," said Donald H. Trautlein, chairman. "And steel prices are very depressed. We, therefore, expect to incur a significant loss in the first quarter."

The rest of the year will hinge on the effectiveness of the government's import program, said Mr. Trautlein.

National Steel had net profits of $1.9 million in the fourth quarter and $20.8 million for all of 1984. Contributing to profits was the liquidation of $39.5 million in inventory.

Most of the major mills were converting inventory to cash in 1984. This emptying of pipelines could result in an abrupt tightening of supply in 1985.

Going from deficits in 1983 to profits in 1984 were Cyclops Corp.; Lukens, Inc.; Quanex Corp.; Florida Steel Corp.; and Copperweld Corp.

Carpenter Technology Corp. continues in its own separate, profitable world. Carpenter earned 5.9 pct on sales in the most recent quarter reported.

Nonferrous

Producers of base nonferrous metals found it difficult to squeeze much in the way of profits out of so-so business levels in the fourth quarter of 1984. Imports siphoned off most of the cream from the domestic copper and aluminum markets and the main legacy of the business recovery of 1984 was a sharp draw-down of hedge market inventories of copper, aluminum and nickel.

North American aluminum producers were battling with rising inventories of aluminum ingot through the second half of the year and a series of production cuts (extending through the current quarter) didn't bring much improvement in free market ingot prices. Aggregate aluminum shipments of Aluminum Co. of America; Alcan Aluminium, Ltd.; Reynolds Metals Co., and Kaiser Aluminum & Chemical Corp. were off 4.1 pct in the fourth quarter at 1.5 million short tons.

Reynolds Metals scored a sizable gain in fourth quarter net that reflected mainly a better product mix. Alcoa's poorer product mix reportedly reflected clearance sales of ingot, production of which Alcoa has cut back further in the current period. Alcan's ingot and mill product shipments both were down and the company said prices for both categories fell during the fourth quarter, particularly in the North American market. Imports of ingot and mill products were sharply higher in 1984.

Alcoa Chairman Charles W. Parry said pressure on mill product prices will continue through the first half of 1985, "reflecting low ingot and scrap prices and a high level of imports into the U.S."

Mr. Parry said Alcoa's capital budget for 1985 is $668 million. The company spent $594 million for capital improvements last year, about $6 million less than was budgeted. Most of the emphasis is being directed toward quality and capacity expansion in the rolling sector, which is expected to get more competitive in the future.

Alcoa's fourth quarter results also were impacted by writedowns of facilities and the cancellation of work on a planned expansion of a smelter in North Carolina.

Kaiser Aluminum credited its fourth quarter loss to lower aluminum prices and restrictions on mill product capability from modernization work at its big Trentwood, Wash., mill.

Revere Copper & Brass, Inc., said its primary aluminum operations were in the red because of low prices but aluminum results overall were helped by improved earnings of the Wells extrusion group and a substantial turnaround by the aluminum sheet mill at Scottsboro, Ala., which is being sold to Noranda Aluminum Co. Revere's fabricated copper and brass segment experienced lower sales prices and volume in the fourth quarter.

Asarco, Inc., took a $236.1 million fourth quarter loss, including a $216 million charge for indefinite suspension or permanent closing of certain mine and plant facilities and the writedown of certain assets. Operating results were adversely affected by weak prices for copper, silver, lead and zinc. These contributed to a fourth quarter loss before the writedowns of $20.3 million. Asarco had net income of $11.7 million in the fourth quarter last year.

Phelps Dodge Corp. scheduled a $195 million charge against fourth quarter results to restructure certain operations.

Inco, Ltd., managed a $4.5 million profit for the fourth quarter of 1984, breaking a chain of 13 quarters in the red. Inco said the gain reflected mainly substantially lower production costs and its average realized price for primary nickel, including intermediates, was $2.29 a lb., the same as it was in the final period of 1983, when the company sustained a $54.6 million loss. Inco carried 88 million lbs of finished nickel inventory into 1985, about 5 million lbs more than it had in stock a year earlier. The nickel inventory on the London Metal Exchange dropped sharply last year and this, together with political difficulties in New Caledonia, have strengthened hedge market prices since the turn of the year.

Inco's nickel shipments moved up to 356 million lbs last year from 314 million lbs in 1983 and production moved up to 359 million lbs from 283 million lbs in 1983.

Falconbridge, Ltd.'s, net was down for the fourth quarter but results for the year were substantially better with an $80.2 million profit compared with a $16.6 million (Canadian funds) loss in 1983.

OFF THE DRAWING BOARD AND INTO THE FACTORY

COMPUTERS IN MANUFACTURING

Tough competition is forcing firms toward computer-integrated manufacturing. Yet the CIM marketplace abounds with new products and vendors. Distinguishing the major players is a problem.

By Robert Harvey

In years past, computer-integrated manufacturing (CIM) was considered "Star Wars" technology—thought-provoking though impractical. Today, however, CIM is no longer science fiction.

The sudden importance of CIM is underscored by the rush of players into the CIM arena. Software, hardware, and systems vendors are hurriedly hammering out or polishing up their CIM strategies.

Just a few weeks ago, for example, Honeywell, Inc., a major computer manufacturer, announced its integrated information and control systems architecture for manufacturing automation. The architecture addresses a wide range of process, batch, and discrete parts manufacturing operations. Honeywell, which has been a major supplier of process technology, will use this process expertise to establish a CIM beachhead in the discrete parts manufacturing marketplace.

Also recently, Digital Equipment Corp., Maynard, Mass., arguably the largest supplier of computer equipment for factory floor systems, opened a research and development center, called CIMLAB 1, for building and testing computer-integrated manufacturing systems. The facility will help Digital customers develop their own particular CIM strategies.

The developments at Honeywell and Digital are representative of the intensive efforts in recent months by a great number of hardware, software and systems developers to prominently position themselves in the CIM marketplace, a market beginning to show signs of awakening. Increasing worldwide competition is forcing manufacturers to view CIM no longer as a luxury.

For the executive, however, who is considering installing these CIM products, this kaleidoscope of vendors, technologies, and strategies can be overwhelming. At one end of the spectrum are the people attacking CIM on a broad front, at the other end reside niche players.

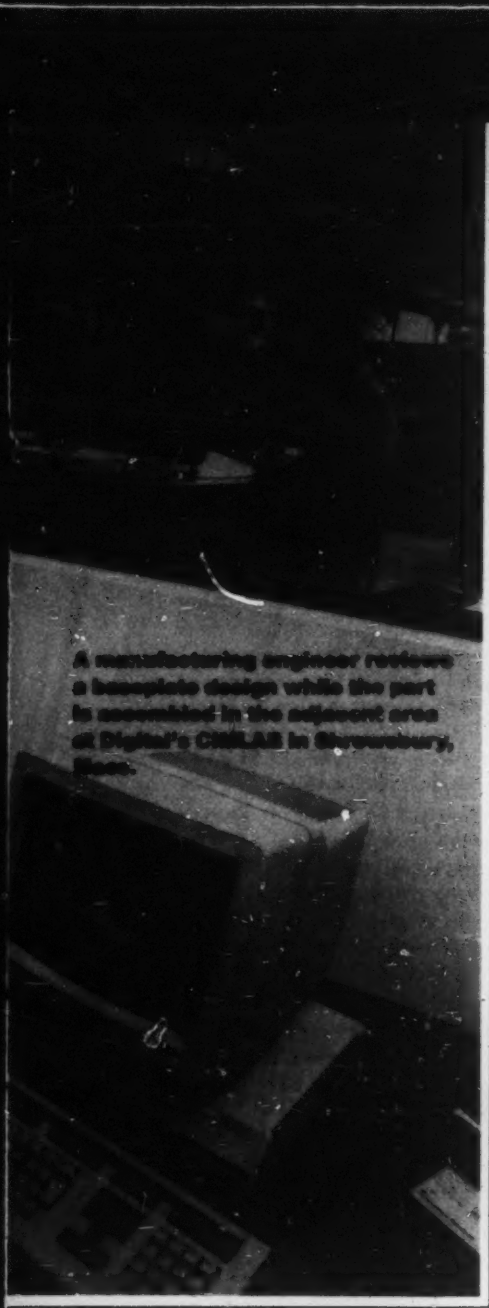
Examples of firms using the broad brush approach include computer makers like Honeywell, IBM, Hewlett-Packard, Digital, Gould, and Data General; systems and component suppliers like Schlumberger, General Electric and Westinghouse; as well as some machine tool and material handling firms, software vendors and system engineers.

As mentioned earlier, Honeywell has positioned itself to supply CIM expertise to a wide variety of companies involved in process, batch, or discrete manufacturing.

"Let me describe our view of manufacturing automation," explained William W. George, executive vice president, control systems, at Honeywell. "To us it comprises the total spectrum of industrial production, from the extraction of raw materials through the handling of finished goods."

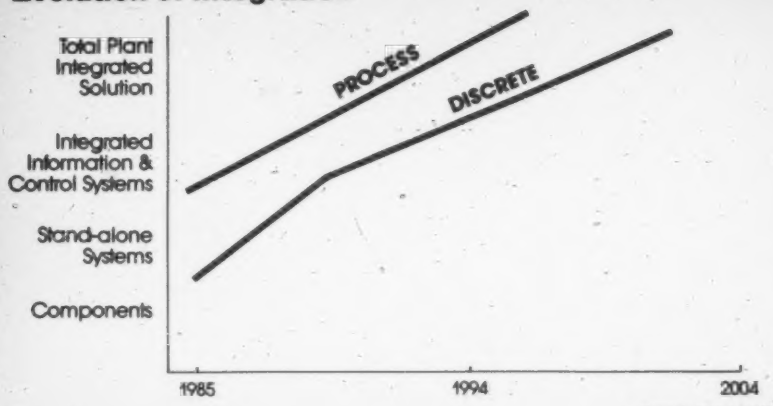
Over the past 20 years, the process industries, such as oil refining, chemicals, and pulp and paper, have developed very sophisticated control systems for running their continuous and batch processes.

"Their automation systems include advanced control features such as closed-loop control, full redundancy, operator verification, distributed control and process optimization," said Mr. George. "At the same time, the discrete industries



A manufacturing engineer reviews a baseplate design while the part is assembled in the adjacent area at Digital's CIMLAB in Shrewsbury, Mass.

Evolution of Integration



Source: Honeywell

Integration has been slow catching on in discrete parts manufacturing. However, during the next two decades, integration efforts will pick up considerably.

U.S. Manufacturing Automation Market

(In Billions of Dollars)	1985	1990	1995	Growth Rate
Manufacturing Planning & Control/Communications	$3.8	$8.4	$14.5	15%
Process Control	3.1	5.5	10.0	12
Programmable Controllers	.6	1.4	3.0	18
Sensors/Actuators	2.4	4.7	9.3	15
CAD	$1.7	$4.5	$12.0	22%
Robotics	.4	2.1	4.5	27
Machine Tools	5.3	9.7	18.0	13
Automated Inspection & Test	3.0	7.2	12.0	15
Automated Material Handling	5.0	8.9	15.0	12
Total	**$25.3**	**$52.4**	**$98.3**	**15%**

Source: Honeywell

such as automotive, appliances, machinery and consumer electronics, have been concentrating on improving the efficiency of the work place, individual machine operations and the movement of materials.

"Until recently, automation in discrete manufacturing focused on the sub-sets of an activity required to make a product. But now it is becoming clear that highly automated discrete manufacturing will look much more like a continuous process. Thus, many of the control technologies now used in continuous processes will be found in the factories of the future."

Communication Needs

Besides addressing a range of industries, Honeywell is tackling the automation and communication needs within particular factories.

"A manufacturer needs a system in which all components can communicate so that information from a sensor on a factory floor can move up to the department manager, the plant manager, and ultimately the top executives. This systems integration effort is one that manufacturers usually choose not to do themselves and can't risk leaving to an outside software house," said Mr. George. "What many manufacturers are looking for today is support in developing their manufacturing automation plan."

To strengthen its position in discrete parts automation, Honeywell last year invested in Industrial Solid State Controls (ISSC), a maker of programmable controllers and communications products, and acquired Digital Datacom, Inc., a maker of factory-floor microcomputers and supervisory workstations.

More recently, Honeywell announced its integrated information and control architecture for process to discrete manufacturing operations and will support the manufacturing automation protocols (MAP) being proposed by GM.

Honeywell has also introduced a new Supervisory Work Center, the WCC 1250, which provides data processing and reporting on quality control, work-in-process status, maintenance scheduling and testing.

Another firm approaching CIM with a broad brush is Schlumberger. The company has acquired a matrix of companies, giving Schlumberger the ability to address a variety of automation needs.

When Schlumberger looked at

manufacturing, it saw three major kinds of products being made: computer chips, printed circuit boards which housed the chip, and larger products, the automobiles, the airplanes, the machines, which increasingly contained chips and boards.

To address these three manufacturing segments Schlumberger formed Computer-Aided Systems (CAS) to provide computer-aided design (CAD), computer-aided engineering (CAE), computer-integrated manufacturing (CIM), computer-aided manufacturing (CAM), and computer-aided testing (CAT) support.

"There are five companies or units now in CAS," explained Daniel J. Sliski, director of marketing services, Applicon. "They include Applicon, Benson, MDSI, Factron, and Sentry, and look what you have got: a CAD company (Applicon), a plotter vendor (Benson), an NC company (MDSI), a subassembly test company (Sentry) and a component test company (Factron). For CAD and CAE, primarily we look to Applicon and Benson. Manufacturing Data Systems Inc. (MDSI) along with Applicon are charged with addressing CIM and CAM. The other two firms handle CAT."

Unbroken Chain

Although each unit in CAS retains its own identity, Schlumberger primarily is looking for an unbroken chain of technology from concept to finished product over three broad areas of manufacturing.

As the leading player within this environment Applicon sees itself playing an increasingly larger role in industrial automation efforts.

The key to tomorrow's automation efforts is integration. A major part of integration efforts today involve getting a wide variety of dissimilar hardware, computers, machine tools, CAD systems, whatever, to talk to each other.

"Nevertheless, I think that this hardware integration is the easiest task we have," said Mr. Sliski. "Getting equipment to talk together is not the big challenge, the bigger challenge is integrating software.

"If you look at a piece of software, it is usually there so it can do a particular application. (Will it do the job?) The other element in the piece of software is the user interface. (How to I get it to do this job?) You also have to have a data storage and retrieval mechanism. (What does it do with the data?)".

All is well with this arrangement until multiple applications are run, then problems develop. New application software usually comes with a unique user interface and also a unique way of storing and retrieving data.

"Applicon didn't like this approach, so we came up with a common user interface and a consistent way for you store and retrieve dat and a data base management system to keep watch over that data."

With its BRAVO software system providing software compatibility to go along with the hardware compatibiljty that is being developed, Applicon sees itself in a good posi tion to address CIM needs.

Another company that has recently re-dedicated itself to solving the problems of CIM is Digital Equipment Corp. Digital's major effort is to address the problems developing in large companies as they try to integrate across a great diversity of equipment and operations.

"We define CIM as the ability to integrate the entire manufacturing enterprise which may include a number of different companies working together," explained Jack Conaway, Digital's CIM marketing manager. "In the auto industry, for instance, GM has a number of suppliers, dealers, ad agencies and the like and somehow the whole enterprise has to work together. What these large companies are asking us for is to make some real progress against corporate goals that they are trying to satisfy, goals like time-to-market, quality of product, customer satisfaction, asset management, and flexible product mix."

No Direction

However, companies continue to buy automation for automation sake without regard for overall direction or general corporate goals.

"A good example of that is what is going on in the CAD/CAM world," observed Mr. Conaway. "Most vendors approach the problem as a task automation problem. They are not really concerned with what happens to the data after it gets out of their realm of influence. A company may achieve four-to-one productivity increases in computer-aided design, but if they are now shipping three times as much paper over to their manufacturing engineering people, they may not be getting any progress against their time-to-market goal."

Digital's CIM strategies include supplying data management tools that include getting heterogeneous systems to talk to each other.

"Our strategy is to use common data interfaces and standards which allow the customers to select various types of task automation from different vendors," said Mr. Conaway. "One thing we are doing is building a CIM architecture that includes a number of standards able to interface different types of applications."

Digital's offerings will not be application software but the integration software that ties everything together. One, BASEWAY manufacturing software, allows firms to monitor and control automation devices like programmable controllers and bar code readers.

Data General, Westboro, Mass., is another computer company rapidly moving into CIM. Its aim is to offer an extensive product platform with a variety of the application-specific software. "DG is not in position to walk into some company and put a turnkey $5 million flexible manufacturing system in place," said David Allen, manager industry marketing, Technical Products Div., "although we would work very closely with a GE, Westinghouse, CDC, or GCA, in integrating the Data General story into their turnkey solution."

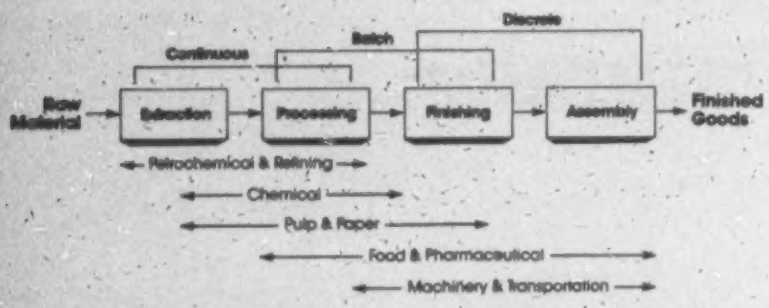
Data General has been moving toward CIM for some time.

"We really started out in the CPU (computer) business, peddling iron to the marketplace," said Mr. Allen. "From there we got more into systems. We now like to talk about our 'integrated product platform.' This is basically what we are supplying to many of our major OEMs."

Computer Hardware

If a computer system starts with

Industrial Production Cycle



With its new integrated control systems architecture for manufacturing automation, Honeywell will be able to address all three elements of the production cycle.

the computer hardware, the next need are systems which define how the hardware is to operate. Then comes the integrated product platform, and on top of that is applications software which addresses specific automation tasks. A key layer is the integrated product platform level which not only is the communications link between the host computer and specific factory automation activities but also transports information from these activities horizontally throughout the factory. Working hard to improve its communication abilities, Data General has announced MAP support while also supporting Ethernet and SNA. Besides developing its integrated product platform, Data General also provides host computers, systems, and application solutions.

Application solutions can involve three areas: engineering design, manufacturing information (MRP), and factory automation.

"We got started in the engineering world about two years ago and now we have most of the popular engineering packages—NASTRAN, ANSYS, and ANVIL, for example—running on our 32-bit superminicomputers," said Mr. Allen. "We are just now now putting together a number of solutions in the MRP, simulation area. In the factory automation area, we are forming linkages between a 32-bit CPU or a workstation, and what are really workers on the factory floor: robots, vision systems, material handling, bar coding, NC, and so on."

To create this link Data General is forming strong relationships with a leading company in a particular field. It already has ties with a major material handling company and a leading sensor I/O manufacturer and is talking with vision and bar coding companies, to name a few. The ties are needed so the customers don't have to do all the work in putting together a system.

"We are saying that we will offer you a 32-bit Data General product. And from a strategic partnership relationship company, you can buy the pretested interface board and the driver software. We are trying to get the customer away from dealing with the interface issues which are always a pain in the neck."

Prime Computer, Inc., Framingham, Mass., produces a broad line of superminicomputers. It is also a company that is moving into the CIM marketplace. Its particular strength is supplying the CAD/CAM market. A major customer, Ford Motor Co., uses Prime systems in a large percentage of its CAD/CAM operations.

Linking Systems

"A lot Prime systems were being used in CAD/CAM," said Robert O. Carper, group marketing manager, Automotive and Aerospace CAD/CAM Business Group. "We believed we that we could bring together these CAD/CAM systems with business systems, because the multifunctional capability of the Prime product allows you to run engineering systems and business systems equally effectively."

This balance, often not addressed, is found in most environments today. Engineers, for example, usually split their time between a graphics workstation and administrative duties.

Besides having design systems, Prime accommodates a number of popular CAE offerings. CAM is also supported as is computer-aided process planning. Prime can also tie into third-party MRP packages and shop floor systems.

"What we are working toward is having a range of systems working work together on the same system. For example, we have a CAD system, Prime MEDUSA, a drafting and 3-D solids modelling package. At the other end of our product line, we have a data base management system called INFORMATION. Its strength is that it allows people without a great deal of programming experience to access information. What we are doing is creating a link between our CAD system and INFORMATION so the engineer can build the drawing and build the associated specifications, then take it out of that drawing data base and put it into into another data base, an engineering management data base. Here, he can work with creating bills of material. He can create part specification listings and he can tie then directly to his MRP system."

NCR, another computer and software developer, has two groups that support CIM. One group makes hardware that runs on the shop floor while the other group has developed MISSION, a comprehensive MRP, accounting, and shop floor control software package.

"We bought Data Passing, Inc., a shop floor hardware producer, about five years ago and they have continued as separate division," remarked Peter J. Augusta, assistant vice president, general purpose systems. "However, they have just this year been integrated into the overall

manufacturing division environment. They have the terminals and we sell the main frames and we will be working more closely with them to integrate their terminals into our manufacturing systems."

Mainframe Link

Another product NCR soon will be offering is a microcomputer to mainframe link. The micro can be then used as either a dumb terminal or a personal computer, running all the major PC software.

"As for the future, We are looking very seriously CAD and the integration of CAD into our MRP system," said Mr. Augusta.

While NCR offers hardware and software CIM solutions, Manufacturing Science America Inc. (MSA) is a firm that markets strickly software, MRP II software. However this software continues to reach into more and more areas of production. Like NCR, MSA sees the growing integration of MRP and CAM, manufacturing management and design.

"The possibility of tying those areas together is getting closer," said Ray L. Dicasali, vice president, Manufacturing Systems Div. "The biggest problem we have to over come is making the CAD data base compatible with the MRP data base. Another area we are looking at is the whole issue of shop floor data collection. Most of it is being tracked manually. We have got terminals that is true but mostly there are pieces of paper flying around, never quite catching up to what they are supposed to be reporting."

The paperwork falls even further behind as plants adopt just-in-time production philosophies.

"It appears we are heading toward a paperless electronic form of communication, however before this communication can become reality the problem of the lack of standards must be addressed. This lack of standards is are real barrier to closing the information loop in a factory. Automated information systems must be tied more closely to the automated hardware that is being installed."

ASK Computer Systems, Inc. is another software firm that now is addressing the CIM environment. "The big challenge to running an MRP system like ours is to make sure that it is accurate and up-to-date all the time," said Kenneth A. Fox, vice president of the Los Altos, Calif., firm. "In other words, the general objective is to try and get very high accuracy in the inventory records, which is nothing more than a making sure that what the computer thinks is in inventory is in fact what is in inventory. Today in most MRP systems, ours included, that tracking is done by people entering inventory transactions, releasing shop paper and so on. As the other functions become more automated, it becomes natural to keep the MRP system tracking the manufacturing processes electronically."

ASK sees a logical link between automated storage and retrieval systems (AS/RS). Since AS/RS automates the stockroom, why should stockroom information have to be manually put into an MRP system?

ASK also is working on tying MRP to CAD. "This is the interface that our customers see as most important," said Mr. Fox, "because more people own CAD systems than any other of the islands of automation. We are also working on streamlining data entry on the shop floor via bar code readers. Another development I see coming in a year or so is an MRP link with automated test equipment. We have a quality data management package under development."

Many more companies than the few mentioned are expanding their lines to meet the increasing demand for CIM products. And this initial demand is only the beginning.

What Must Be Integrated Before CIM Can Become Reality

Levels of Automation

LEVEL	REPRESENTATIVE FUNCTIONS	
LEVEL IV COMPANY-WIDE INFORMATION SYSTEMS	• Financial modeling • Business tracing/ reporting • Payroll	• General ledger • Credit • Asset management
LEVEL III PLANT-WIDE PLANNING & CONTROL (Plant Manager)	• MRP • Work in process • labor reporting • Cost control • Quality control	• Planning/scheduling/ forecasting • Inventory control • CAD interface • Order entry
LEVEL II SUPERVISORY (Department Manager)	• Report generation • Operations analysis/ control • Optimization planning • Change control	• Recipe/program storage & control • Data base maintenance • Operations displays • Maintenance scheduling
LEVEL I MACHINE/WORK CELL (Factory Floor)	• Closed loop control • Sequence and logic control • Source data entry	• Specialty controllers • Robotics control • LANS
LEVEL 0 COMPONENT/ SENSOR	• Pressure, temperature, distance, humidity, flow measurement • Transducers • Relays, switches	• Operator interface • Data acquisition • Transmitters • Object recognition

Source: Honeywell

PRICE & PRODUCTION DATA

(Effective February 18,1985)

Steel production by districts, thousands of tons (000 omitted)

	Last Week	Two Weeks Ago	Month Ago	Year Ago
Northeast Coast	185	163	160	239
Pittsburgh	223	198	184	298
Youngstown	97	101	97	120
Lake Erie	161	151	139	129
Detroit	136	134	136	152
Chicago	451	456	439	547
Cincinnati	88	87	82	99
St. Louis	76	71	77	85
Southern	171	173	154	200
Western	86	85	82	81
U.S. Production	1,674	1,619	1,550	1,961

Source: American Iron & Steel Institute

Lake Superior Ore Prices

51.50% Fe Natural delivered lower Lake ports. Rail transportation, handling and unloading may be charged to the account of the buyer. Coarse ore 80¢ premium.

Pellets (per iron unit natural) ..... gross-ton 80.50-86.9*
Mesabi, regular-unscreened ..... gross-ton $32.53
Mesabi, non-bessemer ..... gross-ton $30.03-31.53**

*80.50¢—Pickands Mather as of 1/27/81
86.9¢—U.S. Steel as of 3/15/82. Cleveland-Cliffs as of 2/26/82. Oglebay Norton as of 3/25/82, and Hanna Mining as of 2/26/82
**Effective 8/1/83

STEEL PRODUCTION, COMPOSITE PRICES

(Effective February 18,1985)

U.S. Steel Production	Last Week	Two Weeks Ago	To Date 1985	To Date 1984
Net tons, in thousands	1,674	1,619	10,439	12,262
Capability Utilization Rate	64.7	62.5	60.0	69.9

Composite Prices	This Week	Week Ago	Month Ago	Year Ago
Finished Steel Base* (¢/lb.—eff. 7/1/84)	27.582	27.582	27.582	26.822
Pig Iron** (Net ton = 2000 lbs.)	$213.00	$213.00	$213.00	$213.00
Scrap No. 1 hvy.*** (Gross ton = 2240 lbs.)	$ 83.83	$ 82.50	$ 81.50	$ 95.17
No. 2 bundles	$ 55.83	$ 54.83	$ 53.50	$ 63.17

Scrap Comparison (Gross Ton)

No. 1 steel, Pittsburgh	$ 89.50	$ 86.50	$ 83.50	$103.50
No. 1 steel, Philadelphia	81.50	80.50	80.50	91.50
No. 1 steel, Chicago	80.50	80.50	80.50	90.50
No. 1 bundles, Detroit	75.50	75.50	70.50	101.50
Low Phos., Youngstown	72.50	72.50	72.50	104.50
No. 1 mach'y cast., Pgh	71.50	71.50	66.50	79.50
No. 1 mach'y cast., Phila	98.50	98.50	98.50	100.50
No. 1 mach'y cast., Chi	111.50	111.50	111.50	111.50

*Finished Steel Composite: Weighted index of steel bars, shapes, plates, wire, rails, black pipe, hot and cold rolled sheets and strips.
**Pig Iron Composite: Based on average prices for basic and foundry pig iron at representative producing points within the U.S.
***Steel Scrap Composite: Average of No. 1 hvy. melting steel scrap and No. 2 bundles delivered to consumers at Pittsburgh, Philadelphia and Chicago.

NONFERROUS PRICES

(Effective February 18,1985) Prices obtained in trade based on representative tonnages per gross ton delivered to consumer unless otherwise stated.

Primary Metal Prices

(cents per lb.)	current price	last price	date of change
Aluminum (LME)	50.47	49.86	2/18/85
Copper (C)	67.00-68.00	66.50-67.00	2/13/85
Lead	13.00-21.00	19.00-21.00	2/12/85
Magnesium Ingot	148.00	143.00	5/25/84
Nickel (LME)	229.57	228.76	2/18/85
Titanium Sponge	555.00-585.00	555.00	4/29/82
Zinc	43.00	43.00-45.00	1/22/85

ALUMINUM: Avg. for last week & previous week. COPPER (C) = cathode. LEAD: common grade. MAGNESIUM: 99.8% pig, delivered. NICKEL: Avg. for last week & previous week. Canada. ZINC: high grade.

Antimony, American Laredo, Texas	$2.00
Beryllium-aluminum 5% Be, per lb. contained Be	$230.00
Beryllium-copper, per lb. cont. Be	$140.00
Beryllium 97% powder 200	$178.00
Cadmium, ton lots	$1.25-1.55
Calcium, ton lots, crown	$3.76
Chromium, 99.8%	$3.75
Cobalt, 99%, cathode	$12.50
Gold per troy oz.	$304.00
Indium, dollars per troy oz.	$3.10
Iridium, dollars per troy oz.	$475.00
Magnesium sticks, 10,000 lbs.	$1.97
Mercury, per 76-lb. f.o.b. N.Y.	$310.00-319.00
Molybdenum, lb. tech. moly oxides, 20 lb. MO can	$6.85
Nickel electro (PDCR)	$3.29
Palladium, per troy oz.	$129.00
Platinum, per troy oz.	$273.00
Rhodium, per troy oz.	$1,030.00
Silver ingots, per troy oz.	$6.265
Vanadium	$6.00
Zirconium sponge	$12.00-17.00

(Per lb. unless otherwise noted)

Straits Tin Price

(U.S. cents per lb. EX-SMELTER, based on daily market in Penang in Malaysian dollars per kilo.)

Feb.11—517.52
Feb.12—Holiday
Feb.13—517.52
Feb.14—517.66
Feb.15—517.52

Scrap Prices
Brass Mill Scrap

(Cents per lb; over 20,000 lbs. add 1¢ per lb)

	Solids	Turnings
Copper	61½	52¼
Yellow brass	55	50½
Red brass	57⅜	51
Comm. bronze	58⅝	51¾
Mang. bronze	57⅛	47
Free cutting rod ends	53	52

Custom Smelters Scrap

(Cents per lb., carload lots, del. refinery)

No. 1 copper wire	57
No. 2 copper wire	49
Light copper	40

Ingot Makers Scrap

(Cents per lb., carload lots, del. refinery)

No. 1 copper wire	53
No. 2 copper wire	45
Light copper	36
No. 1 composition	47
No. 1 comp. turnings	45
Hvy. yellow brass solids	35
Hvy. yellow brass turnings	33
Radiators	38

Aluminum

New mixed clips	35	— 36
Old sheet	33	— 34
Old cast	33	— 34
Clean dry borings	34	— 35

Dealers' Scrap

(Dealers' buying price f.o.b. New York in cents per pound)

Aluminum

Segregated clippings	29	— 30
Mixed L.C. clips	27	— 28
Old sheets and cast	24	— 26
Borings and turnings	22	— 23
Duraluminum clippings	25	— 26

Copper and Brass

No. 1 copper wire	45	— 46
No. 2 copper wire	37	— 38
Light copper	32	— 33
Radiators	32	— 33
No. 1 composition	40	— 41
No. 1 composition turnings	37	— 38
Cocks and faucets	30	— 32
Clean heavy yellow brass	28	— 29
Brass Pipe	28	— 29
New soft brass clippings	41	— 42

Lead

Heavy soft lead	9	— 10
Whole batteries	1	— 3
Type metal	16	— 17
Electrotype	13	— 14

Nickel

Nickel solids	115	—120
Nickel rod ends	115	—120
Nickel sheets, clips	115	—120
Nickel turnings	40	— 45

Zinc

New zinc clippings	18	— 19
Old diecast zinc	14	— 15

EFFECTIVE FEBRUARY 18,1985

(Effective February 18,1985) Prices obtained in trade based on representative tonnages per gross ton delivered to consumer unless otherwise stated. Prices are the opinions of *Iron Age* editors and correspondents, based on contacts with dealers, brokers, generators and users in the industry on the effective date listed above.

Ferrous Scrap Prices

Pittsburgh

No. 1 hvy. melting	$ 89.00 to	$ 90.00
No. 2 hvy. melting	79.00 to	80.00
No. 1 dealer bundles	107.00 to	108.00
No. 1 factory bundles (auto)	96.00 to	97.00
No. 2 bundles	56.00 to	57.00
No. 1 busheling	107.00 to	108.00
Machine shop turnings	10.00 to	11.00
Shoveling turnings	51.00 to	52.00
Cast iron borings	49.00 to	50.00
Low phos. punchings plate	109.00 to	110.00
Heavy turnings	79.00 to	80.00
No. 1 RR hvy. melting	93.00 to	94.00
Rails, 2 ft. and under	112.00 to	113.00
Scrap rails, random lgth	94.00 to	95.00
RR specialties	102.00 to	103.00
No. 1 machinery cast	71.00 to	72.00
Cupola cast	64.00 to	65.00
Heavy breakable cast	30.00 to	31.00
Stainless		
18-8 bundles and solids	590.00 to	600.00
18-8 turnings	490.00 to	500.00

Chicago

No. 1 hvy. melting	$ 80.00 to	$ 81.00
No. 2 hvy. melting	75.00 to	76.00
No. 1 dealer bundles	99.00 to	100.00
No. 1 factory bundles (auto)	96.00 to	97.00
No. 2 dealer bundles	59.00 to	60.00
No. 1 busheling	95.00 to	97.00
Shredder scrap	96.00 to	97.00
Machine shop turnings	44.00 to	45.00
Mixed borings and turnings	45.00 to	46.00
Shoveling turnings	50.00 to	51.00
Cast iron borings	50.00 to	51.00
Low phos. forge crop	116.00 to	117.00
Low phos. punchings plate 1/4 in. and heavier	129.00 to	130.00
Low phos. 2 ft. and under	124.00 to	125.00
No. 1 RR hvy. melting	92.00 to	93.00
Scrap rails random lgth	92.00 to	93.00
Reroller rails	107.00 to	108.00
Rails, 2 ft. and under	116.00 to	117.00
RR couplers and knuckles	101.00 to	102.00
RR car axles	123.00 to	124.00
No. 1 machinery cast	111.00 to	112.00
Cupola cast	99.00 to	100.00
Stove plate	97.00 to	98.00
Steel car wheels	104.00 to	105.00
Stainless		
18-8 bundles and solids	530.00 to	540.00
18-8 turnings	450.00 to	460.00
430 bundles and solids	135.00 to	140.00
430 turnings	105.00 to	110.00

Philadelphia

No. 1 hvy. melting	$ 80.00 to	$ 83.00
No. 2 hvy. melting	70.00 to	73.00
No. 1 dealer bundles	91.00 to	94.00
No. 2 dealer bundles	50.00 to	53.00
No. 1 busheling	91.00 to	94.00
Shredder scrap	101.00 to	104.00
Machine shop turnings	26.00 to	29.00
Mixed borings and turnings	26.00 to	29.00
Shoveling turnings	38.00 to	41.00
Low phos. 5 ft. and under	90.00 to	93.00
Low phos. 2 ft. punchings	110.00 to	113.00
Electric furnace bundles	104.00 to	107.00
RR specialties	90.00 to	93.00
Rails, 2 ft. and under	112.00 to	115.00
Cupola cast	80.00 to	83.00
Heavy breakable cast	57.00 to	60.00
No. 1 machinery cast	97.00 to	100.00

Detroit

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 58.00 to	$ 59.00
No. 2 hvy. melting	57.00 to	58.00
No. 1 dealer bundles	75.00 to	76.00
No. 2 bundles	35.00 to	36.00
No. 1 busheling	74.00 to	75.00
Drop forge flashings	45.00 to	46.00
Machine shop turnings	48.00 to	49.00
Mixed borings and turnings	24.00 to	25.00
Shoveling turnings	49.00 to	50.00
Cast iron borings	31.00 to	32.00
Heavy breakable cast	40.00 to	41.00
Mixed cupola cast	56.00 to	57.00
Automobile cast	80.00 to	81.00
Stainless		
18-8 bundles and solids	465.00 to	475.00
18-8 turnings	370.00 to	380.00
430 bundles and solids	110.00 to	120.00

Youngstown

No. 1 hvy. melting	$ 69.00 to	$ 72.00
No. 2 hvy. melting	52.00 to	55.00
No. 1 dealer bundles	81.00 to	84.00
No. 2 dealer bundles	35.00 to	38.00
Machine shop turnings	11.00 to	14.00
Shoveling turnings	16.00 to	19.00
Low phos. plate	71.00 to	74.00
Electric furnace bundles	69.00 to	72.00
Galvanized bundles	59.00 to	62.00

Cleveland

No. 1 hvy. melting	$ 58.00 to	$ 61.00
No. 2 hvy. melting	34.00 to	37.00
No. 1 dealer bundles	73.00 to	76.00
No. 1 factory bundles	79.00 to	82.00
No. 2 bundles	22.00 to	25.00
No. 1 busheling	75.00 to	78.00
Machine shop turnings	6.00 to	9.00
Mixed borings and turnings	6.00 to	9.00
Shoveling turnings	7.00 to	10.00
Cast iron borings	10.00 to	13.00
Cut structural & plates, 2 ft. and under	110.00 to	113.00
Low phos. punchings plate	110.00 to	113.00
Drop forge flashings	40.00 to	43.00
Foundry steel, 2 ft. & under	57.00 to	60.00
No. 1 RR hvy. melting	73.00 to	76.00
Rails, 2 ft. and under	117.00 to	120.00
Rails, 18 in. and under	118.00 to	121.00
Steel axle turnings	58.00 to	59.00
Railroad cast	89.00 to	91.00
No. 1 machinery cast	99.00 to	101.00
Cupola cast	55.00 to	58.00
Stove plate	41.00 to	44.00
Stainless		
18-8 bundles	375.00 to	385.00
18-8 turnings	325.00 to	335.00
430 bundles	80.00 to	85.00

Buffalo

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 67.00 to	$ 68.00
No. 2 hvy. melting	55.00 to	56.00
No. 1 busheling	79.00 to	80.00
No. 1 dealer bundles	79.00 to	80.00
No. 2 bundles	40.00 to	41.00
Machine shop turnings	16.00 to	17.00
Mixed boring and turnings	17.00 to	18.00
Shoveling turnings	27.00 to	28.00
Cast iron borings	24.00 to	25.00
Low phos. plate	97.00 to	98.00
Structural and plate, 2 ft. and under	100.00 to	101.00
Rails, 2 ft. and under	100.00 to	101.00
Scrap rails, random lgth	74.00 to	75.00
No. 1 machinery cast	80.00 to	81.00
No. 1 cupola cast	60.00 to	61.00

St. Louis

No. 1 hvy. melting	$ 64.00 to	$ 65.00
No. 2 hvy. melting	53.00 to	54.00
Foundry steel, 2 ft	61.00 to	62.00
No. 1 dealer bundles	64.00 to	65.00
No. 2 bundles	48.00 to	49.00
Machine shop turnings	17.00 to	18.00
Shoveling turnings	23.00 to	24.00
Cast iron borings	27.00 to	28.00
No. 1 RR hvy. melting	64.00 to	65.00
Rails, random length	65.00 to	66.00
Rails, 18 in. and under	81.00 to	82.00
RR specialties	80.00 to	81.00
Cupola cast	74.00 to	75.00
Heavy breakable cast	52.00 to	53.00
Stove plate	89.00 to	90.00
Steel car wheels	97.00 to	98.00
Rerolling rails	78.00 to	79.00
Unstripped motor blocks	61.00 to	62.00

Birmingham

No. 1 hvy. melting	$ 73.00 to	$ 74.00
No. 2 hvy. melting	69.00 to	70.00
No. 1 dealer bundles	77.00 to	78.00
No. 2 bundles	50.00 to	51.00
No. 1 busheling	77.00 to	78.00
Shredder scrap	99.00 to	100.00
Machine shop turnings	29.00 to	30.00
Shoveling turnings	42.00 to	43.00
Cast iron borings	39.00 to	40.00
Electric furnace bundles	74.00 to	75.00
Elec. furnace, 3 ft. & under	74.00 to	75.00
Structural and plate, 2 ft.	100.00 to	101.00
Structural and plate, 4 ft.	92.00 to	93.00
No. 1 RR hvy. melting	92.00 to	93.00
Scrap rails, random lgth	90.00 to	91.00
Rails, 2 ft. and under	105.00 to	106.00
Angles and splice bars	92.00 to	93.00
No. 1 cupola cast	87.00 to	88.00
Unstripped motor blocks	75.00 to	76.00

Cincinnati

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 52.00 to	$ 53.00
No. 2 hvy. melting	51.00 to	52.00
No. 1 dealer bundles	63.00 to	64.00
No. 2 bundles	25.00 to	26.00
Machine shop turnings	4.00 to	5.00
Shoveling turnings	6.00 to	7.00
Cast iron borings	17.00 to	18.00
Low phos. 18 in. and under	84.00 to	85.00
Rails, random length	65.00 to	66.00
Rails, 2 ft. and under	78.00 to	79.00
No. 1 cupola cast	58.00 to	59.00
Heavy breakable cast	25.00 to	26.00
Drop broken cast	75.00 to	76.00

New York

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 47.00 to	$ 48.00
No. 2 hvy. melting	38.00 to	39.00
No. 2 dealer bundles	23.00 to	27.00
Mixed borings and turnings	11.00 to	13.00
Machine shop turnings	6.00 to	7.00
Shoveling turnings	14.00 to	15.00
Clean cast, chem. borings	35.00 to	36.00
No. 1 machinery cast	89.00 to	90.00
Mixed yard cast	50.00 to	51.00
Heavy breakable cast	10.00 to	12.00
Stainless		
18-8 prepared solids	495.00 to	515.00
18-8 turnings	395.00 to	415.00
430 prepared solids	90.00 to	110.00
410 solids	80.00 to	90.00

Boston

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 58.00 to	$ 60.00
No. 2 hvy. melting	48.00 to	50.00
No. 1 dealer bundles	58.00 to	60.00
No. 2 bundles	35.00 to	37.00
No. 1 busheling	65.00 to	67.00
Shredder scrap	65.00 to	67.00
Machine shop turnings	10.00 to	12.00
Shoveling turnings	18.00 to	20.00
No. 1 machinery cast	81.00 to	86.00
Mixed cupola cast	48.00 to	50.00
Heavy breakable cast	8.00 to	10.00

San Francisco

No. 1 hvy. melting	$ 44.00 to	$ 46.00
No. 2 hvy. melting	38.00 to	40.00
No. 1 dealer bundles	35.00 to	37.00
No. 2 dealer bundles	20.00 to	22.00
Machine shop turnings	8.00 to	9.00
Cast iron borings	8.00 to	9.00
No. 1 cupola cast	81.00 to	83.00

Los Angeles

No. 1 hvy. melting	$ 47.00 to	$ 49.00
No. 2 hvy. melting	40.00 to	42.00
No. 1 dealer bundles	38.00 to	40.00
No. 2 dealer bundles	20.00 to	22.00
Machine shop turnings	13.00 to	14.00
Shoveling turnings	10.00 to	11.00
Cast iron borings	8.00 to	9.00
Elec. furnace, 1 ft. and under (foundry)	74.00 to	76.00
No. 1 cupola cast	75.00 to	77.00

Seattle

No. 1 hvy. melting	66.00 to	68.00
No. 2 hvy. melting	57.00 to	59.00
No. 2 bundles	40.00 to	42.00
No. 1 cupola cast	92.00 to	93.00
Mixed yard cast	82.00 to	84.00

Hamilton, Ont.

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 86.00
No. 2 hvy. melting, cut 2 ft. and under	78.00
No. 1 dealer bundles	84.00
No. 2 bundles	60.00
Mixed steel scrap	57.00
Bush. new fact. prep'd	86.00
Bush. new fact. unprp'd	75.00
Machine shop turnings	31.00
Short steel turnings	33.00
Mixed borings and turnings	25.00
Cast scrap	85.00

Houston

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 74.00 to	$ 75.00
No. 2 hvy. melting	61.00 to	62.00
No. 2 bundles	46.00 to	47.00
Machine shop turnings	14.00 to	15.00
Crushed turnings	31.00 to	33.00
Shredder scrap	78.00 to	79.00
Cut structural plate, 2 ft. and under	105.00 to	106.00
Cut structural plate, 5 ft. and under	89.00 to	90.00
Unstripped motor blocks	60.00 to	61.00
Cupola cast	82.00 to	83.00